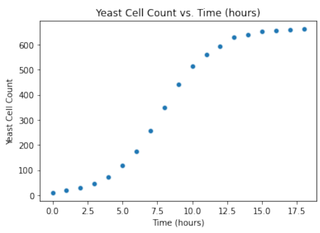
In [1]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
```

In [2]:
```
bacteria_data=pd.read_csv("data/M142_Homework1_Data.csv")
bacteria_data
```

Out[2]:

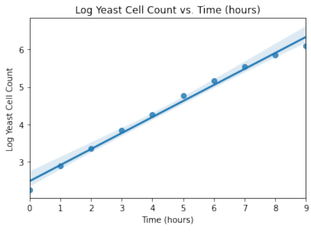
	Time (hours)	Yeast Cell Count
0	0	9.6
1	1	18.3
2	2	29.0
3	3	47.2
4	4	71.1
5	5	119.1
6	6	174.6
7	7	257.3
8	8	350.7
9	9	441.0
10	10	513.3
11	11	559.7
12	12	594.8
13	13	629.4
14	14	640.8
15	15	651.1
16	16	655.9
17	17	659.6
18	18	661.8

In [48]:
```
sns.scatterplot(data=bacteria_data,x="Time (hours)",y="Yeast Cell Count")
plt.title("Yeast Cell Count vs. Time (hours)")
plt.savefig("Q_4_Hw_1_142_a.png")
```



In [10]:
```
bacteria_exp=bacteria_data[bacteria_data["Time (hours)"]<10]
```

In [50]:
```
sns.regplot(data=bacteria_exp,x=bacteria_exp["Time (hours)"],y=np.log(bacteria_exp["Yeast Cell Count"]))
plt.ylabel("Log Yeast Cell Count")
plt.title("Log Yeast Cell Count vs. Time (hours)")
plt.savefig("Q_4_Hw_1_142_b.png")
```



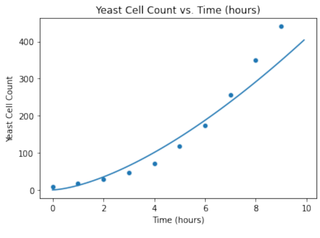
In [21]:
```
fit=np.exp(np.polyfit(bacteria_exp["Time (hours)"],np.log(bacteria_exp["Yeast Cell Count"]),1))
fit
```

Out[21]:
```
array([ 1.5328075 , 12.03305581])
```

In [40]:
```
corr=np.corrcoef(bacteria_exp["Time (hours)"], np.log(bacteria_exp["Yeast Cell Count"]))
corr[1][0]
```

Out[40]:
```
0.9944986908084287
```

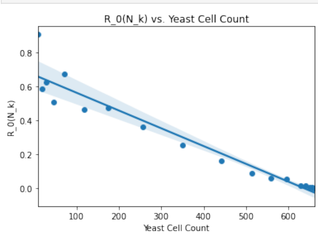
In [49]:
```
x_0=np.arange(0,10,0.1)
y_0=fit[1]*np.power(x_0,fit[0])
sns.lineplot(x=x_0,y=y_0)
sns.scatterplot(data=bacteria_exp,x=bacteria_exp["Time (hours)"],y=bacteria_exp["Yeast Cell Count"])
plt.title("Yeast Cell Count vs. Time (hours)")
plt.savefig("Q_4_Hw_1_142_c.png")
```



In [25]:
```
r_0=np.array([])
for x in np.arange(len(bacteria_data)):
    if x==18:
        r_0=np.append(r_0,0)
    else:
        r_0=np.append(r_0,(bacteria_data["Yeast Cell Count"][x+1]-bacteria_data["Yeast Cell Count"][x])/bacteria_data["Yeast Cell Count"][x])
```

In [26]:
```
bacteria_data["R_0(N_k)"]=r_0
```

In [51]:
```
sns.scatterplot(data=bacteria_data,x="Yeast Cell Count",y="R_0(N_k)")
sns.regplot(data=bacteria_data,x="Yeast Cell Count",y="R_0(N_k)")
plt.title("R_0(N_k) vs. Yeast Cell Count")
plt.savefig("Q_4_Hw_1_142_d.png")
```



In [41]:
```
corr_2=np.corrcoef(bacteria_data["Yeast Cell Count"], bacteria_data["R_0(N_k)"])
corr_2[1][0]
```

Out[41]:
```
-0.9652771067429227
```

In [38]:
```
fit_2=np.polyfit(bacteria_data["Yeast Cell Count"],bacteria_data["R_0(N_k)"],1)
fit_2
```

Out[38]:
```
array([-0.00104662,  0.66844655])
```

In [43]:
```
k=-1*1/fit_2[0]
k
```

Out[43]:
```
955.4535128353328
```